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LATERAL CURVATURE  
OF THE SPINE

—  
WILLIAM JAMES TIVY.



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# LATERAL CURVATURE OF THE SPINE.

ITS PATHOLOGY; AND TREATMENT BY  
THE PORO-PLASTIC JACKET,  
PARTIAL RECUMBENCY,  
AND EXERCISES.

BY

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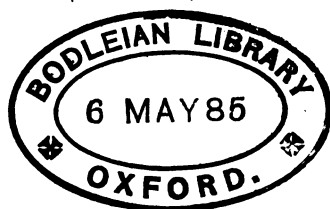
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RESPECTFULLY DEDICATED TO THE  
MEMORY OF  
MY LATE FRIEND AND PARTNER,  
MR. CHARLES GREIG, F.R.C.S.,  
OF CLIFTON.



## PREFACE.

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IN this small work, I have endeavoured to lay considerable stress on the necessity for early and assiduous treatment of lateral curvatures of the spine, as doubtless, it is the experience of most surgeons that parents and guardians of young girls (for undoubtedly it is in the female sex that we see by far the larger number of these cases) seem very frequently to overlook even the growing out of a shoulder, which can hardly be considered a very early symptom, or the habit of persistently sitting or standing in awkward positions; or if they do notice any of these defects, as a rule the child or ward is reproved, as if it were in the power of the sufferer, by her own unaided exertions, to remedy the complaint; and, early surgical aid being neglected, permanent curvature is frequently allowed to take place, which surgical treatment, however judiciously followed out, is unable in many cases entirely to remove. I have also drawn attention to the danger of the term



“Weak Spine,” which is so often applied to cases of Incipient Curvature, which have not been recognised as such by the surgeon in attendance. Attention is also drawn to the fact that cases of lateral curvature, in order to be successfully treated, must be seen by the medical attendant at short intervals. It has been too much the custom to make the treatment of the spine a specialty, whereas the treatment which I advocate comes within the reach of every practical surgeon, and has been pursued by me for the past six years with almost unvarying success. The treatment which I adopt is, in great part, that of self-suspension by Sayre’s tripod and the use of the poro-plastic jacket, which I have applied, with or without suspension, nearly three hundred times. Partial recumbency, and the systematic use of properly regulated exercises enter largely into the system of treatment.

I have to thank Mr. W. Adams for his great kindness in permitting me to use several of his plates.

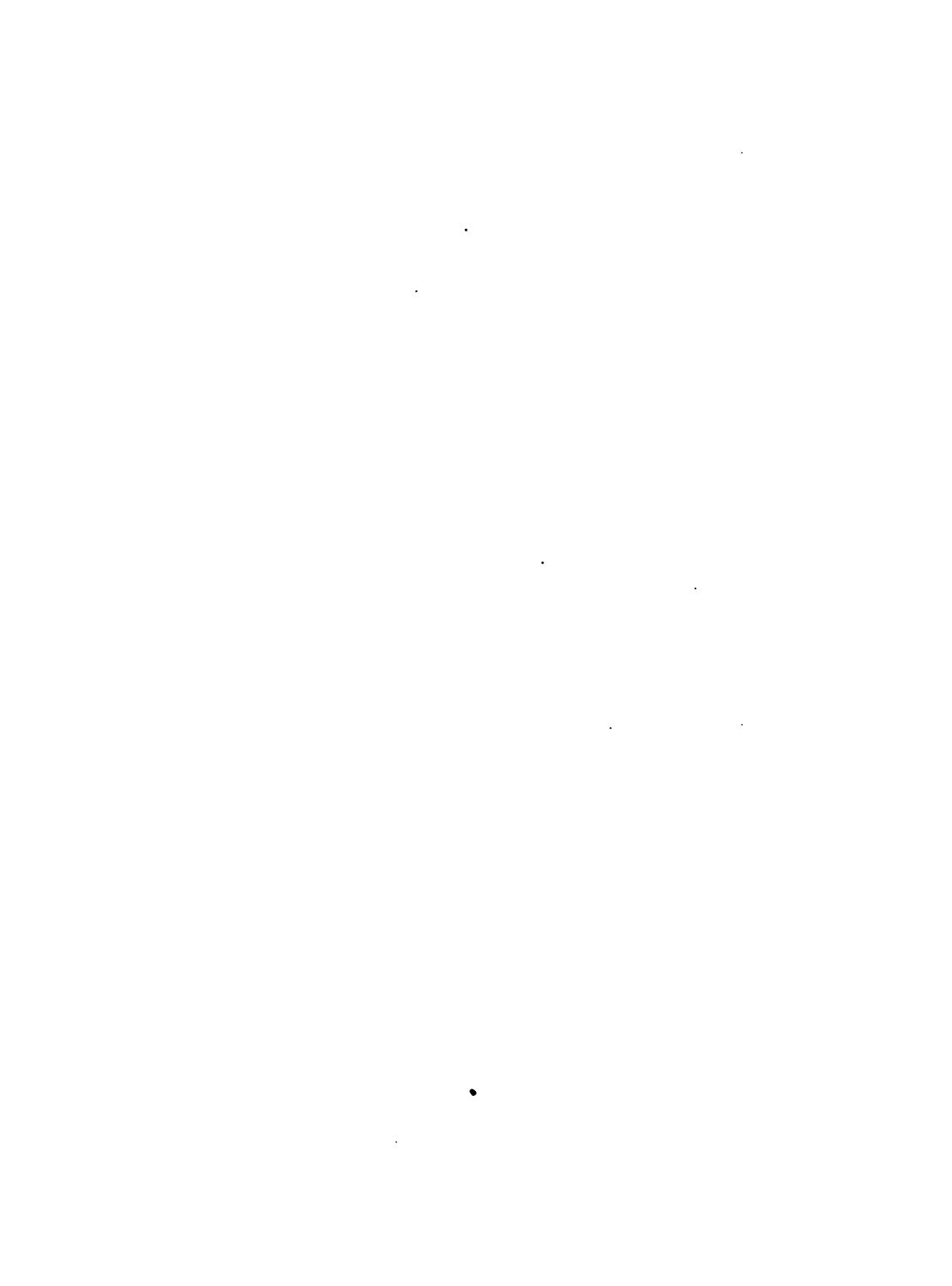
W. J. T.

8, LANSDOWN PLACE,

CLIFTON, *December*, 1884.

# CONTENTS.

	PAGE
PREFACE      ...      ...      ...      ...      ...	v.
CHAPTER I.	
INTRODUCTORY ...      ...      ...      ...      ...	1
CHAPTER II.	
LATERAL CURVATURE.—ETIOLOGY      ...      ...      ...	5
CHAPTER III.	
SYMPTOMS OF LATERAL CURVATURE      ...      ...	32
CHAPTER IV.	
PROGNOSIS AND TREATMENT ...      ...      ...	37
CHAPTER V.	
CASES OF LATERAL CURVATURE      ...      ...      ...	62



## CHAPTER I.

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### INTRODUCTORY.

THE spinal column consists of twenty-four vertebræ, besides the sacrum. The bodies of the vertebræ, except the first and second, are separated from each other by intervertebral fibro-cartilages, which act as pads to withstand shocks, and permit of a certain amount of articulation between them; the chief articulatory processes are, however, situated on the transverse processes, and are behind the bodies of the vertebræ, and when the human body is bent to either side, as Mr. Adams remarks, pressure is exerted upon these processes, and thus the structural changes seen in these articular processes in severe cases of lateral curvature are accounted for. The spinal column is about two feet in length and, observed laterally, it presents several curves — the Cervical, the Dorsal, the Lumbar, and the Pelvic. The Cervical is convex in front, and is not well marked; the Dorsal is

concave anteriorly; the Lumbar and the Pelvic are convex anteriorly. Gray, Bichat, Biclard, and others, maintain that the spinal column in health is curved slightly to the right, but this is doubtful, and several modern observers, including Mr. Adams and others, reject this view. The natural curves of the spine vary in different individuals. The intervertebral substances separating the bodies of the vertebræ consist of fibro-cartilage, and vary in shape, size, and thickness in the several regions of the spine. They are largest in the lumbar region; almost uniform in thickness in the dorsal, while in the cervical and lumbar regions they are thicker anteriorly than posteriorly, thus partly accounting for the forward convexity in these regions, and in this way they contribute to a great extent to form the curves of the neck and loins, while in the dorsal region, the intervertebral discs being nearly of the same substance throughout, the concavity of this region is due to the bodies of the vertebræ being less thick in front than behind. These discs possess considerable elasticity.

The motions of the spine are numerous—Flexion, Extension, Lateral motion, Circumduction, and Rotation. In flexion, which is the most extensive movement of the spine, the intervertebral cartilages are compressed in front. In extension the reverse

takes place. This motion, as a rule, is comparatively slight, but in acrobats, in whom a twisting back of the spine has been begun early, the anterior ligaments seem to stretch to a large extent, and the scope of the articulations between the transverse processes is much increased, while the approximation of the spinous processes must in this movement be very close. Flexion and extension are performed most freely in the cervical and lumbar regions, less so in the dorsal. The lateral motion is performed in all parts of the spine, but mostly in the neck and loins.

Circumduction is slight. Rotation is seen to a certain extent in all parts of the spinal column. The rotatory capabilities of the spine are well exhibited by acrobats, who, by constant and early practice in swinging the body round and round, the pelvis being fixed, produce an extraordinary amount of rotation between the bodies of the vertebræ.

The muscles and ligaments of the spine must, I consider, take a considerable part in supporting the erect position of the spinal column. This is apparently borne out by the fact, observed by Mr. Noble Smith, that "The lax condition of the spinal and other joints of the body of a dead person, or of one temporarily insensible, renders

it impossible to keep the spine of a person in either state in an upright position, even when the individual is seated in a chair." I entirely agree with Mr. Adams that the spine denuded of its muscles but not of its ligaments is still a firm column; but I cannot agree that it preserves correctly its normal shape with all its natural curves. In the act of 'standing at ease' the spinal muscles are doubtless almost in a state of repose, but in military marching there can be little doubt that the spinal muscles are thrown into active tension to preserve the erect position of the head and spine. The previous remarks must not be thought to imply that in voluntarily bending the spine to either side, or rather allowing the spine to bend to either side, the spinal muscles on the concave side are tense. This is not the case; but in violently forcing the body to either side the muscles on the concave side will be found to be tense; and although in the majority of cases of lateral curvature there is no tension of the muscles in the concavity of the curve, in some cases I have seen so much muscular tension, not Hysterical, as to require subcutaneous section in order to effect a cure. To this fact Dr. Sayre refers in his book, and quotes a case or two; Mr. Barwell also has advanced the same view.



## CHAPTER II.

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### LATERAL CURVATURE.—ETIOLOGY.

LATERAL curvature of the spine may be defined to be a deviation of the spinal column in a lateral direction, accompanied in all cases by more or less rotation of the vertebræ involved in the curve. In some incipient cases, however, the rotation is hardly, if at all, perceptible; while in all confirmed cases it is most marked. Cases of lateral curvature are well divided, as Mr. Brodhurst suggests, into two classes—Incipient and Confirmed. Cases of Incipient curvature are those in which on the patient lying in the recumbent or prone posture the curve is absolutely removed; in which also there is no undue prominence of the ribs, or of the transverse processes of the vertebræ on stooping forwards. This latter symptom was, I think, first mentioned by Mr. Adams, whose class of ‘Weak spines’ I consider ought to be included in that of Incipient Curvature. In confirmed cases the ribs



and the transverse processes of the vertebræ are unduly prominent on the convex side of the principal curve; also the curve is not entirely removed on assuming the recumbent position.

The Causes of lateral curvature are many. The Predisposing causes are chiefly: Debility, either constitutional or arising from some extraneous cause, producing weakness of the muscles of the back, and thus allowing the spine to incline to the side of which the shoulder and arm are chiefly used; and this being generally the right side, in the majority of cases the first curve has its convexity towards the right side. The structural changes in the bodies of the vertebræ and the intervertebral discs are subsequent and in great part owing to prolonged pressure. By far the larger number of cases of lateral curvature I have treated, presented marked muscular weakness. Rickets is also a predisposing cause, generally by producing obliquity of the pelvis, and thus a lateral curve. The structural changes in the bodies of the vertebræ and the intervertebral discs are not due mainly to a rickety condition of the spinal joints, but, as mentioned before—to the prolonged pressure to which they are exposed in cases of lateral curvature.

Muscular contraction is considered by Mr.

Barwell and Dr. Sayre to be the chief cause of lateral curvature; and though in the majority of cases this does not seem to be so, as shown by the relaxation of the muscles generally present in such cases, still I have certainly seen more than one case in which there was marked muscular tension in the concavity of the curve, overcome with difficulty by repeated rubbings and the use of a well-fitting appliance. Wry neck is certainly a predisposing cause of lateral curvature. This I have seen exemplified in a case of contraction of the right sterno-mastoid muscle recently under my care, in which I divided the muscle sub-cutaneously, and thus was enabled to treat the lateral curve satisfactorily by the use of an instrument and friction of the muscles of the neck and back. Females are much more liable to lateral curvature than males, and people in the higher classes of life are more subject to it than the poor; and as debility and anæmia are more prevalent among town-dwellers than among country folk, so naturally among the former this complaint is more common. Too rapid growth is also a pre-disposing cause. Rheumatic Gout is decidedly a cause of lateral curvature. I have seen at least two cases, both very severe ones, which succeeded the onset of Rheumatic Gout;

and both occurred in patients about thirty years of age.

Mr. Adams very correctly considers that those cases which occur early in life are probably congenital, while in most cases occurring later some further cause must be assigned.

Among the Exciting causes may be mentioned : bad habits into which young girls fall of standing in awkward positions, on one leg, for example—prolonged writing, drawing, or music lessons. Young children sitting on a hard form without a back, their feet not resting firmly on the ground, run a great risk of acquiring a spinal curve. The long fatiguing walks taken by young and delicate girls are also an exciting cause ; excessive horse exercise acts in the same way. All young girls who ride much ought to use saddles which will enable them to ride on either side, using them on alternate days. An excessive amount of needlework, particularly sewing-machine work, is a very frequent cause, dressmakers being very liable to this complaint. Carrying heavy weights on one side, as nursing a heavy infant, for example, is another cause. The use of tight stays may be a cause in a few cases, owing to the muscular weakness which this practice entails, although in the majority of cases it cannot be so considered, as lateral curvature



most frequently commences long before tight, if any, stays are worn.

Mr. Barwell attributes the fact that European women suffer from lateral curvature so much more than Asiatics to the wearing of tight clothing by the former. But, as I have just mentioned, the majority of cases begin in childhood, before tight clothing is used, and therefore this cannot be the cause. I consider the European mode of life, the improper training of children, and the neglect of proper muscular exercises are the true cause of the greater frequency of the deformity in Europe.

Inequality in the length of the legs, the loss of either arm, and the resulting muscular weakness, are a cause of lateral curvature. Effusion into the pleura is a cause; but in this case it is an aid, there is generally no rotation; Mr. Noble Smith, however, has found it present in some cases examined by him. Hip disease certainly produces a lateral curve in many cases; also knock-knee: valgus and varus. Injuries of the lower extremities; fracture of the femur, or tibia may produce it.

Dr. Sayre maintains that lateral curvature is produced entirely by irregular muscular contraction; and in this theory he is supported by Mr. Barwell, Dr. Jules Guérin, and Dr. Dods.

Against this theory it may be mentioned that in the majority of cases of extreme lateral curvature, in which post mortem dissections have been made, the muscles and nerves on the concave side of the curve have been found atrophied. However, as previously mentioned, in some rare cases the muscles on the concave side are much enlarged and rigid, showing that muscular contraction occasionally occurs.

The excessive use of the muscles of one side of the body, as in the case of blacksmiths and others, is sometimes an exciting cause. Mr. Childs records the case of a printer's apprentice who suffered from a dorsal curve with its convexity to the right side, the Rhomboidei and Trapezius muscles being tense and prominent, the deformity having been produced by his pulling the press constantly with his right arm. I have seen several cases of lateral curvature produced by caries of the cervical region. Lateral curves are, as a rule, single or double, but many writers speak of three, four, or even five curves as existing in the same patient. Single curves are generally found in the lumbar region, occasionally in the dorsal. Double curves generally appear in the dorsal and lumbar regions, the deviation being in opposite directions, one curve being compensatory to the other. The

natural tendency of the head being to preserve the upright position, a single curve, as Mr. Adams

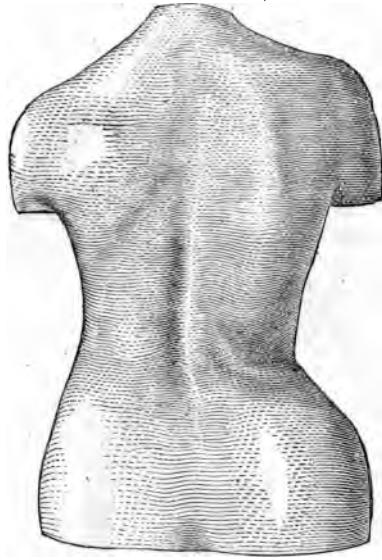


FIG. 1.—Single Lumbar Curve—after Adams.

remarks, can hardly be said to exist, as in order to maintain the erect posture there must necessarily be a compensating curve, though it may be so slight as occasionally to escape observation. In fig. 1, which represents a single lumbar curve, I

think on close observation a secondary dorsal curve will be noticed in an incipient stage. In figs. 2



FIG. 2.—Moderately severe case of Lateral Curvature in dorsal region—after Adams.

and 3, which represent, according to Mr. Adams, moderate and severe cases of single dorsal curvature, I cannot help thinking that secondary lumbar curves are discernible, though these plates represent most accurately what are generally known

as single dorsal curves. I cannot agree with the theory that in all cases, both curvatures,

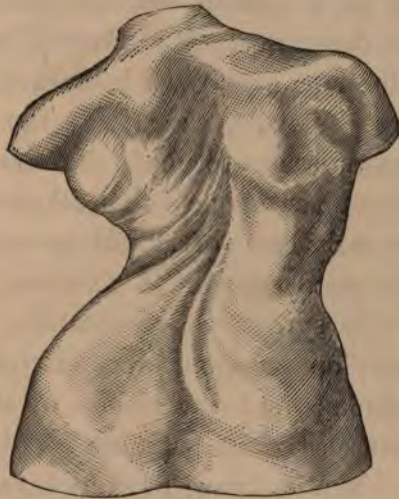


FIG. 3.—Severe case of Single Dorsal Curvature—after Adams.

if there be two, take place simultaneously, or nearly so, as I have seen several patients in whom a primary curve has been succeeded in from six to twelve months by a secondary or compensating curve, evidently, I should say, to preserve the



equilibrium of the body ; this occurred in cases in which proper treatment had been either too long postponed or altogether neglected. When two curves exist, the longer increases much more rapidly than the shorter. Several small curves may exist in a patient without producing any appreciable deformity. Mr. Barwell states that primarily the ribs are drawn backwards, and that thus, acting as levers, they twist the vertebræ. This statement seems to imply that muscular contraction takes place on one side in all cases, whereas in all those early cases of lateral curvature, which we are fortunate enough to discover, there are generally few symptoms of rotation, and these are removed on stooping and on lying in the prone position ; and invariably in these early cases the muscles of the back are found relaxed on both sides ; and it is rare, even in advanced cases, to find the muscles contracted and tense. Single lumbar curves give rise to the growing out of the hip, which is very often the first symptom noticed and for which the surgeon is consulted (see fig. 1). An unduly prominent hip corresponding to the concavity of a lateral curvature is easily recognized, and may be considered diagnostic of this complaint. In such cases the crest of the ilium is prominent, owing to the falling away of the lumbar

muscles on the concave side of the curve; the reverse is to be observed on the convex side. The depression on the one side and the prominence on the other are caused by, and depend upon, the rotation of the spinal column, though in rare cases they may be due to muscular contraction. Mr. Lonsdale insisted upon the diagnostic value of the unduly prominent hip in single curve of the spine, and Mr. Adams also draws special attention to it. The apices of the spinous processes in single lateral curvature do not, as a rule, deviate very much from their natural position: the prominent hip is the chief sign. A single curve in the dorsal region is generally very long, I have seen the entire length of the dorsal spine together with some of the lumbar vertebræ engaged in a single curve; and though generally the symmetry of the body is much altered in such cases, still in some, and those severe cases too, the height of the shoulders is maintained uniform. These are, however, exceptional. In bad cases the scapulæ are unequally distant from the spinous processes which frequently so far deviate from the natural position as to lie under, and to be in great part concealed by, the scapulæ on the convex side.

In advanced cases also the ribs project posteriorly on the convex side, and are depressed on

the concave side; this gradually increases, unless checked by treatment, and the angle of the ribs becomes more acute on the convex side, and the ribs are unduly drawn apart. The converse is the effect on the concave side of the curve. When a single curve takes place high up in the dorsal region the patient presents a high-shouldered appearance, one shoulder being markedly higher than the other.

In double curvature the convexity of the upper curve is generally found in the dorsal region, and to the right, while the lower or lumbar curve has its convexity to the left. Right lateral curvature is more frequent than left, in the proportion of about five to one. In double curvature the greatest amount of deformity is produced by a large and long dorsal curve, in conjunction with a small lumbar one, in which cases one shoulder, usually the right, is much higher than the other. Equal, or almost equal curves, produce, as a rule, very little deformity, the shoulders in such cases being nearly level. In fig. 4, which represents a case of double curvature in which the curves are nearly equal, it will be seen that the shoulders are almost level in height.

I have, however, seen an exception or two to this rule, a long right dorsal curve with a small

lumbar curve, producing little inequality in the height of the shoulders. As in long single curves

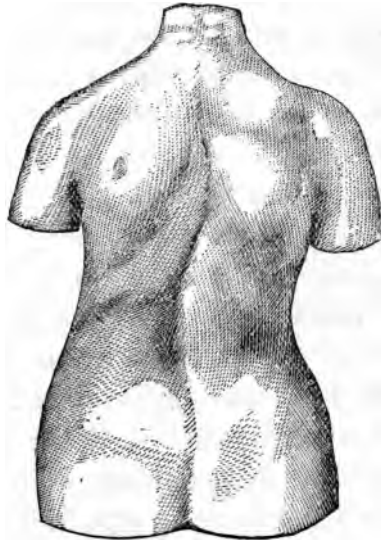


FIG. 4.—Double Lateral Curvature of the ordinary form—after Adams.

so frequently in double curves there is not much deviation of the spinous processes from their normal position, even though great deformity may exist, owing to the amount of rotation of the vertebræ.



There is considerable prominence of the scapula on the convex side of the curve when it occurs in the dorsal region. This is more frequently observed on the right than on the left side. The ribs project on the convex side, and are depressed on the concave side. The posterior projection of the ribs on the convex side of the dorsal curve, and of the transverse processes of the lumbar vertebræ, are very valuable diagnostic symptoms of lateral curvature, and are best observed when the patient is placed in a stooping posture, the arms being folded across one another in front. The usual custom of forming a diagnosis by merely passing the hand down the spinous processes is, as I mentioned, very misleading. In case of severe right dorsal curve the right collar-bone becomes unduly prominent, while the lumbar region is not much altered; still, in bad cases (see Fig. 5), there is a prominence of the right hip to correspond with the sinking in of the right lumbar muscles in the concavity of the curve; to a certain extent there is also prominence of the left lumbar muscles in these cases; but these two latter symptoms are generally not well marked.

The dorsal curve is generally the larger, and increases more rapidly than the lumbar, and usually there is a great disproportion in the height

of the two shoulders. This is not, however, universal. In dorsal curves there is increased



FIG. 5.—Severe Case of Double Lateral Curvature—after Adams.

prominence of the scapula, due chiefly to increased angularity of the ribs.

According to some writers there is frequently a diminution of the antero-posterior curves of the spine in lateral curvature, in other words a flat-

tening, even amounting to a depression, of the spinous processes; thus the spine is rendered unnaturally straight; this symptom I have occasionally observed. I cannot entirely agree with Mr. Adams that the undue prominence of the ribs on either side in the stooping position is necessarily seen in all cases of lateral curvature, even in early stages. In more than one early case which I call to mind there was only very slight prominence of the right shoulder in the erect position, and in stooping there was no undue projection of the ribs or muscles over the transverse process on either side.

The Causes of the Rotation of the bodies of the vertebræ in lateral curvature has been variously explained by different writers; some consider that it arises from the way in which the oblique articular processes are pressed together on the concave side of the curve; others that it is due to the muscular contraction of the serratus magnus and trapezius muscles unduly drawing the ribs out of position. But as Mr. Noble Smith remarks, the latter theory is disproved by the fact that in many cases rotation is as complete in the lumbar region, where there are no serrati or trapezii muscles, as in the dorsal. Mr. Fisher also disposes of this muscular theory, which is supported by Mr. Barwell



and Dr. Sayre, by observing that "before the serratus magnus can act, the scapula must be fixed by the trapezius and rhomboidei muscles, and that therefore the spinous processes of the vertebræ, from which these muscles take their origin, must also be stationary, so that the vertebræ must at the same time act as fixed points and become rotated—an obvious impossibility." The most reasonable explanation of the rotation is that it is entirely mechanical; that the spine leaning over to one side owing to muscular weakness, the spinous processes being more or less fixed by ligaments, the bodies of the vertebræ, being free, move without control, and thus rotate more than the spinous processes. Doubtless, the rotation is much increased by the weight being thrown on the oblique articulating processes, and by the yielding of those processes that correspond to the portions of the bodies most pressed upon. The change is a gradually increasing one in unchecked cases of lateral curvature, and though in all cases, however slight, there must be some undue pressure on the intervertebral discs, still on removing the pressure either by lying down, or by a well-adjusted instrument, the discs recover their normal shape. This only takes place in incipient cases, when the elasticity of the discs is unimpaired.



The oblique articular surfaces in the dorsal region become more oblique as the curve increases, and the vertical lumbar processes also become oblique. The alteration in the bodies and intervertebral discs is in all probability prior to any other morbid change. There is displacement of the ribs in nearly all cases; I say *nearly*, as in some cases, though submitted to close and repeated examination, I have been unable to detect any rib alteration.

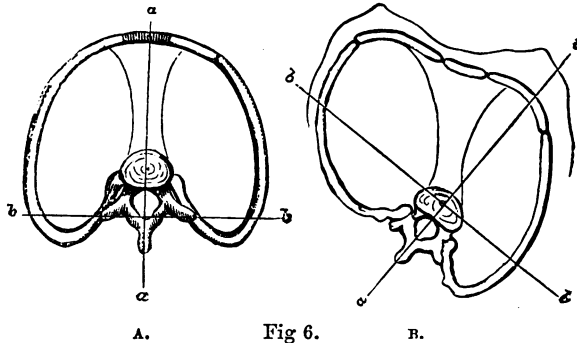
Lateral curvature of the spine without rotation is sometimes found in cases of pleurisy, with effusion, and in empyema. Dr. Dick compares the lateral rotation of the spine to the effect produced on a strong elastic stick held firmly and pressed on both ends in the direction of its length, the centre being free. The stick will then be observed not to bend directly forwards or backwards, but to take a sort of corkscrew shape at the middle part of the bow. Also on pressing in a downward direction the upper part of a healthy spinal column denuded of muscles, the lower part being firmly fixed, distinct rotation will be observed. I consider that lateral curvature takes place first, and that the rotation of the bodies of the vertebræ is secondary to it, and a result of the pressure to which the bodies, the intervertebral discs and the

oblique articular processes are subjected: also that the changes in these parts, viz., alterations in the thickness of the bodies of the vertebræ and intervertebral discs and articulatory surfaces, though existing in nearly all cases, are absent from many slight cases, and even from some cases of long lateral curves in the dorsal region.

Dr. Sayre maintains that even in severe cases of rotary-lateral curvature the bodies of the vertebræ remain of nearly their normal thickness; and he goes on to state that though there is usually some compression of the posterior and expansion of the anterior portions of the intervertebral discs, there is rarely, if ever, any actual 'disease' of these bodies.

Owing to the prolonged pressure to which the bodies of the vertebræ and intervertebral discs are subject in either improperly treated or unchecked cases of lateral curvature, the bodies become wedge-shaped, and more dense in structure upon the lessened side of the vertebra; absorption gradually takes place in the discs, of course more rapidly and more completely on the concave side of the curve. On the convex side the ribs are separated from each other; while on the concave side they are pressed together. In many cases the antero-posterior diameter of the chest on the convex side is most materially diminished, so that not un-

frequently the action of the lung is impeded, and thus pulmonary congestion is produced. The changes which take place in the ribs in a severe case of lateral curvature are well seen in fig. 6 B,



A.—Section of Healthy Chest.

B.—Section of Chest in severe case of Lateral Curvature.  
—After Adams.

which represents a horizontal section of the chest in a severe case; in such a case as this the right lung is very likely to be unduly pressed upon. Compare with this fig. 6 A, which shows a horizontal section of a healthy chest.

Mr. Noble Smith states, that the spinal nerves are rarely pressed upon, even in most aggravated cases. The anterior portions of the ribs and costosternal cartilages frequently become abnormally

prominent on the concave side of the curve, and thus increased depth of chest is produced on this side. In most cases the position of the spinous processes is no index of the amount of deformity. I quite think with Mr. Adams that it is length of duration of the disease, more than degree of the curvature, which is essential to the production of the changes in the bodies of the vertebræ and intervertebral discs. We can quite realize the cause of the changes in the articulations when we bear in mind that these small joints receive the whole weight of the body in resting on one hip, or inclining the body in an awkward position, and being of soft texture they soon begin to alter in shape and appearance. The transverse processes in the convexity of the curve become unduly prominent, and thus assist the diagnosis.

The chest deformity is decidedly greatest in cases of long dorsal curve ; but even to this rule there are occasional exceptions, and when the curves are nearly of the same length the chest deformity is slight. The deformity of the ribs and chest is due, as previously described, to the horizontal rotation of the bodies of the vertebræ. The flattening of the ribs on the convex side of the curve, which gives rise to the shortening of the antero-posterior diameter of the chest on this side, seems to be due



to muscular contraction. The obliquity of the pelvis seen in some cases is undoubtedly due to rickets, and is rarely, if ever, seen in cases unconnected with this disease. Even in advanced cases of lateral curve in patients suffering from rheumatic gout, delivery of a child at full time has taken place without any complication. One sufferer from rheumatic gout with advanced lateral curve gave birth to seven healthy children, the labours being natural. The so frequent apparent occurrence of obliquity of the pelvis, is due to lumbar curvature giving rise to prominence of the hip though no actual deformity of the pelvis exists. Few can doubt that there are some changes in the ligaments of the spine in advanced cases, as there must necessarily be a certain amount of extension of the ligament on the convex, and contraction on the concave side. Still, the amount of ligamentous extension and contraction really existing has undoubtedly been overestimated by some observers. The muscles in the majority of cases of severe lateral curve are wasted on both sides, and pale in colour, being partially degenerated; yet in rare cases the muscles in the concavity are prominent and tense; these cases may, however, be looked upon as entirely exceptional. The muscular prominence

in the lumbar region on the convex side is due, as Mr. Adams remarks, to the muscles being unduly pressed out by the rotated transverse processes. The spinal cord does not suffer from compression, even in advanced cases, and the spinal nerves are rarely pressed upon ; still in some cases of severe curvature an irritable cough is present, indicating spinal irritation ; this is frequently relieved, if not cured at once, by the application of a properly adjusted instrument.

Occasionally, in severe cases, the heart is displaced to the right side. The aorta follows the line of curve of the bodies of the vertebræ, as seen in a specimen in the Royal College of Surgeons of London. This diversion of the aorta seldom causes any ill effect to the patient. In the pelvis, even in severe cases, there is rarely much real obliquity except, as mentioned before, in cases connected with rickets. According to Bouvier, the æsophagus seldom suffers, and is rarely displaced. The abdominal viscera, from being more free from bony coverings, are less likely to suffer than the thoracic. The liver is however the principal organ in the abdominal cavity which suffers, and it is injured to much the same extent in aggravated cases of lateral curve as it is by tight lacing. It is however surprising to what an extent the

liver will accommodate itself to the change of shape and position owing to steadily increasing pressure, without giving rise to many hepatic symptoms. The kidneys and spleen are not affected by lateral curvature. The stomach and intestines also escape any marked ill effects, though many symptoms of gastric disturbance occurring in such cases are cured by restoring the spine to its normal position, and developing the muscles of the back.

The majority of cases of lateral curvature for which surgeons are consulted are in the dorsal region; but it is doubtful whether the larger number were so originally; most probably the cases of lumbar curvature predominate in the early stages, the dorsal curves being secondary or compensatory. One of the reasons why so many cases of dorsal curvature are seen, I consider to be the neglect of parents and guardians in not seeking surgical advice early, when a hip seems to be growing out, or when a child seems to have acquired a bad habit in standing or sitting. I think some members of our profession are not entirely free from blame, for not advising early treatment for incipient lateral curves, or even for curves in the early stage of rotation, when much deformity is not apparent. Cases are far from



uncommon in which parents are lulled into fancied security, by being informed by their medical attendant that their child has only a "tendency" to curvature of the spine, or something of that kind, and that the child will "grow out of it;" whereas rotation of the vertebræ has, perhaps, already begun, and active, persevering treatment, together with the use of an instrument, is absolutely necessary to prevent permanent deformity. Primary lumbar curves may be considered to be most common among the higher classes, and are produced by bad habits; for example, standing on one foot, or sitting awkwardly, or, perhaps, by too much horse exercise, &c. Primary dorsal curves are produced by various causes, and are in all probability most common amongst the poor, being frequently due to carrying heavy weights on one arm, a baby for example.

Girls are much more liable to lateral curvature than boys, in the proportion, in fact, of rather more than eight to one. Girls suffer most because they are naturally weaker than boys, and their pursuits and amusements are not such as to develop the spinal muscles to the same extent; in fact many of the occupations of girls particularly predispose to this ailment; *e.g.*, prolonged drawing, writing,



music, and painting lessons; hand-sewing continued for hours, and frequently sewing-machine working; and in the lower orders laborious house-work, and nursing of infants on one arm by ill-developed girls, who live in impure air, and only have a low ill-nutritious diet. Factory work, in which a large number of young girls work together in a close atmosphere, is I consider, a very common predisposing cause both of spinal curvature and phthisis.

The supposed causes of the lateral curvature occurring so frequently on the right side (Bouvier states the proportion of dorsal curves to the left in comparison with right dorsal curves is as one to seven) are many. The supporters of the muscular theory affirm that owing to the muscles of the right side being used so much more than those of the left, the spine is unduly drawn over to the right side; but this can only be true, as shown before,\* in very rare cases. The idea that the spine naturally leans to the right side is untenable, and is not really the case. Mr. Adams's views seem to be the correct ones, that most of the occupations of females tend to incline the body to the right; and, girls being predisposed to lateral curvature, the spine naturally falls over to the side to which it is

\* See page 10.

most frequently inclined in such occupations as needle-work, drawing, painting, writing, &c. ; and these pursuits being frequently followed for several hours without intermission, the result is often a right lateral dorsal curve. The lumbar curve to the left may also be accounted for by the habit of resting on the right leg when tired, and thus tilting the lumbar spine to the left. Many a spinal curvature would be prevented if children were told to lie down or to sit in an arm-chair when they are noticed to be evidently suffering from fatigue, and are trying to rest their tired muscles by standing on one leg. Lateral curvature begins generally between the ages of nine and fifteen, but sometimes occurs both earlier and later ; the majority of cases which occur before the age of six are due to rickets.

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## CHAPTER III.

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### SYMPTOMS OF LATERAL CURVATURE.

THE early symptoms of lateral curvature of the spine are always very slight, and in young patients (I am not now alluding to infants) in whom the advance of the disease is slow; there may for years be no lesion sufficiently marked to produce derangement of the general health. In cases, however, in which the lateral curve is rapidly increasing the general health is much affected; pains in the spinal region, frequently intercostal neuralgia, and aching of the intercostal muscles are complained of; derangements of the stomach and liver, and debility, frequently occur. In slowly increasing cases though the deformity may be great, still few symptoms pointing to gastric or other derangements are apparent, owing doubtless to the organs having gradually become accustomed to the displacement and subsequent pressure resulting from the extensive deformity.



In all cases, though there may be little, if any, deviation of the spinous processes from the upright position, there will be found a 'growing out' of some part, perhaps at first, a shoulder or a hip. Later we shall find a prominence of the ribs on the convex side, with a projection of the lumbar muscles over the rotated transverse processes and a corresponding depression of the ribs, and frequently of the lumbar muscles on the concave side.

The deviation of the spinous processes must not be much regarded as a diagnostic symptom of lateral curvature.

The chief symptoms are those mentioned above: growing out of a shoulder or hip; undue prominence of the ribs and of the erector spinæ and lumbar muscles on the convex side of the curve, with a corresponding depression on the concave side. These latter symptoms are best seen when the patient stoops forward, and sometimes they can only be detected when the patient is placed in this position. I was much struck with this fact recently, on examining the spine of a very fine girl of seventeen, I could detect no deviation of the spinous processes, the shoulders were perfectly level and the hips equal; the right scapula was however slightly prominent, and on stooping forward there was an un-natural prominence of

four or five of the lower right ribs and a projection of the right lumbar muscles with a depression of the left ribs. I was able to state confidently that rotation had commenced, and accordingly I at once applied an instrument. In bad cases of lateral curvature we frequently find that patients complain of palpitation, dyspnœa, faintness, &c., which are frequently due to the debility and anæmia, which give rise to the curve, and may not be the direct effect of the pressure of the bones of the thorax on the heart and lungs. A very common symptom is pain in the back and sides, and a feeling of weakness in the back. An irritable cough is a not unfrequent symptom, and does not necessarily depend upon an abnormal condition of the throat or bronchial tubes, but is due to spinal irritation; and it does not always occur only in very severe cases.

Owing to undue pressure upon the heart in advanced cases, where there is great osseous deformity of the chest walls, palpitation, irregularity of the pulse, and dyspnœa occur not infrequently; and when the lungs are pressed upon, which often occurs in such cases on the right side, passive congestion is now and then set up, and there is inability to take any rapid exercise owing to the resulting dyspnœa. Tuberculosis also may be



induced through the prolonged osseous pressure, in patients in whose families this disease is hereditary. Many dyspeptic symptoms may be referred to the undue pressure exerted upon the liver. The stomach, spleen and intestines only suffer in consequence of the liver disorder. In the lower limbs pain and weariness, principally on the concave side of the curve, are often complained of. Actual paralysis is rarely produced, though many symptoms of defective nerve power may be observed. Spinal muscular pain varies much in intensity, in some cases being almost hysterical, and of a neuralgic nature; the slightest touch on the muscles in the dorsal region seems greatly to aggravate it, and to induce violent lancinating pain; this occurs most frequently in excitable girls; in other cases the muscular pain is dull and aching, and considerable pressure has to be exerted before any increase of pain is complained of; this dull pain we chiefly observe in phlegmatic patients. I cannot agree with Mr. Adams that the spinal pain "when localised in particular spots may in *all* cases be satisfactorily traced to some of the local structural changes already described as taking place in the spinal column during the formation and increase of the curvature." It decidedly does occur in localised spots in many

cases in which the spine has not undergone structural change; and the pain is generally removed in these cases by improving the general health and developing the muscles, and is frequently cured without the use of any spinal instrument.

As spinal deformity advances, the spinal pain becomes less lancinating and more aching; this latter dull heavy pain is probably in great part due to the continued pressure on the bodies of the vertebræ, and the intervertebral discs.

The uterine functions in young girls are frequently disturbed in cases of lateral curvature; but this seems to be due to the causes of the curve—debility, &c., rather than to the curvature itself.

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## CHAPTER IV.

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### PROGNOSIS AND TREATMENT.

THE prognosis must in all cases be cautious, as sometimes cases, which seem at first sight likely to increase rapidly, become spontaneously cured with slight deformity. This however is exceptional; the natural tendency of all cases of lateral curvature is to produce increasing deformity. The rate and extent of the increase depend however on various circumstances. Those cases, which occur in infancy, in which there is in all probability great weakness of the spinal muscles, are likely to develop considerable deformity unless carefully treated; as are also those that depend upon rickets, and cases in which the chief deformity is in the lumbar region. In all these cases a favourable prognosis must be given with great caution. Cases occurring between the ages of twelve and sixteen, when the health is fairly good and the curves neither very large nor very unequal

in size will in all probability prove more amenable to treatment, and are less likely to result in serious deformity than those that occur at an earlier age. Should the curve be situated in the lower dorsal region, a part to which better support can be given by instruments, we may speak favourably as regards the prospects of a good cure. There are however exceptions to the rule that the occurrence of lateral curvature at a very early age is always unfavourable; one at least of my best cases occurred at the age of six, and was perfectly cured at nine, no deformity remaining, by wearing an instrument. Certainly I must allow that in this case the patient was healthy and the muscles less weak than they generally are in such early cases.

#### TREATMENT.

The modes of treatment proposed by various writers for lateral curvature may be summarised as follows:—

- Entire recumbency.
- Muscular exercises.
- Division of the spinal muscles.
- Mechanical extension.
- Mechanical treatment by support  
and pressure.



These are the systems as mentioned by Mr. Adams. Entire recumbency having clearly the effect of weakening already feeble muscles, and thus enfeebling the constitution generally, must be dismissed as unpractical in all forms of lateral curvature. Muscular exercises, though very useful in most cases of lateral curves, as an adjunct, cannot be looked upon as a correct treatment when used alone; cases being not uncommon in which rowing, dumb-bells, and various other muscle-expanding exercises have been prescribed and pursued with the effect, no doubt, of developing the muscles of the back and arms to a very great extent; but still, in spite of this, the lateral curves have increased to incurable deformity.

Subcutaneous division of the muscles can only be required in very few cases, and it is not generally a successful operation. Mr. Adams mentions a case in which it failed when performed by himself, in conjunction with Mr. Tamplin and Mr. Lonsdale. Dr. Sayre mentions only one successful case in his work on spinal curvature. It is a treatment which ought to be adopted with extreme caution, and may almost be omitted from recognised systems of treatment, the cases requiring it being so very rare.

The system of Mechanical Extension, though



partially adopted by the author in combination with other modes of treatment, cannot be recommended alone, as the elongated spine, owing to its muscles still continuing weak, invariably returns to its former deformity after the extension is removed. The system of mechanical support by instruments, though good as far as it goes, is not sufficient, unless it is supplemented by partial recumbency and the other aids to successful treatment, which I am about to advocate. I may here mention that I entirely disapprove of steel instruments of any kind, particularly those to which crutches are affixed; my invariable experience being that if these crutches are raised sufficiently high to act as a support, as they are intended, to the shoulders, the amount of pain produced by the pressure on the nerves in the axillæ and the inconvenience caused by the interference with the circulation in the arms are so great, that patients cannot endure these crutched instruments without frequently raising the shoulders above the correct level in order to gain temporary ease. In the case of girls who have to perform manual work to gain their livelihood, I have generally noticed that they refrained from wearing their steel instrument until their daily toil was over, thus of course losing the benefit of continuous support. The

chief disadvantage in the usual steel instruments, even when made and applied by the best makers, is that the side-plates intended to support the lower arcs of the convexities of the curves are perpetually becoming loose, owing to the loosening of the screws, the result of the continued pressure; and, the plates being thus allowed to rotate to a greater or lesser degree, the pressure of the plate which ought to be on the lower arc of the curve is exerted in a directly lateral direction, and owing to this the rib deformity is in all probability increased. The weight of the usual steel instruments is also a great drawback.

In the treatment of lateral curvature of the spine many circumstances have to be considered. We must remember that the natural tendency of all lateral curves is to increase, and therefore we must be on our guard in all cases, knowing that, though some cases are undoubtedly cured spontaneously, the great majority are prone to go from bad to worse if neglected or improperly treated. All cases under treatment must be carefully watched for at least two years, and in some a much longer time is required to effect a cure. Early treatment is, in this complaint, of the utmost importance, and if mothers and guardians would pay early attention to what one might call

awkward habits in children, such as standing on one leg, raising one shoulder higher than the other, sitting cross-legged, &c., and would seek immediate advice as soon as they observe that such habits are becoming confirmed, many permanent deformities would be prevented. In nearly all cases of lateral curvature occurring in very young patients the treatment is almost entirely constitutional, the ailment being due so frequently in young children to rickets or an impoverished state of the system owing to impure air or injudicious feeding. The little patient ought to be kept almost entirely in a recumbent position, not allowed to sit upright at all, and wheeled out of doors in a reclining chair. The patient ought almost to live out of doors in fine weather, to be warmly clothed, to have tepid salt-water baths every morning unless contra-indicated, to take cod-liver oil, or iron in the form of phosphates. The spinal muscles ought to be well rubbed with the oiled hand once or twice daily. The diet ought to be highly nourishing, consisting chiefly of milk and farinaceous food. Should the spinal deformity show a tendency to increase in spite of this treatment, a well-fitting poro-plastic jacket, as made by Cocking,\* of

\* Mr. Cocking, I understand, attends also at 58, Welbeck Street, Cavendish Square, London.



Plymouth, of the *finest* and lightest material, ought to be applied. The jacket must be first thoroughly softened by heating in a steam or ordinary oven for from five to ten minutes and then accurately moulded to the patient's figure while in the recumbent position, the spine being placed quite straight and the shoulders and hips level. The jacket will require re-moulding about every fourteen days, and must always be removed at night and re-applied in the morning. It ought to be applied outside a woollen or merino vest and in very young children particularly, the hips, and bony parts ought to be sponged with eau-de-cologne or brandy occasionally to harden the skin and thus prevent any ill-effects from the pressure of the jacket; these parts may also be protected by cotton wadding. The application of the jacket is rarely necessary under the age of six, though some cases such as I have described require mechanical support long before this age. In applying the jacket great care must be taken to scrape the edges quite smooth with a knife before softening it in order to prevent undue friction.

In the majority of such very young patients the curve is only incipient and no rotation of the vertebræ is present, as proved by the absence of

undue prominence of the ribs on the convex side of the curve and of the other symptoms mentioned previously. When therefore a support is deemed advisable it ought to be applied in the recumbent position, as in this position the spine which has not undergone rotation is perfectly restored to its normal position. Should however any rotation have taken place, self-suspension as advised by Dr. Sayre and described below,\* ought to be adopted in the application of the jacket; and great care must be taken to mould the jacket so as to give the chief support to the lower arc of the convexity of the principal curve. Pads of wadding ought also to be applied over the hips and removed after the jacket has hardened, and the patient ought to be kept self-suspended if possible until the hardening process has been completed—a space of time rarely exceeding four or five minutes. In self-suspension the patient should only draw himself up so as to stand on tip-toe, and never actually off the ground. The little patient ought to be seen by the surgeon every week for some weeks, and during the whole time of treatment the interval between the interviews ought never to exceed fourteen days. The reason for this will be explained when describing the treatment for older patients.

\* See page 50.



Between the ages of six to twelve, cases of lateral curvature are more frequent, and the treatment must depend entirely upon the state of the patient's health, the amount of the curve, and its cause.

In incipient cases occurring at this age, that is, between six and twelve years, the treatment is in many respects similar to that of younger children. The general health must be attended to. If the patient is anæmic, sea air, salt-water sponging, and sea bathing, if it agrees. Iron or cod-liver oil as the case may require must be prescribed. The morning bath, tepid or cold, followed by brisk rubbing, is a most useful adjunct in the cure of lateral curvature. Any habits of standing or sitting in constrained positions must be prohibited, and the cause of the complaint in this way removed. There is little doubt that children with flat feet, particularly if at all knock-kneed, are very liable to spinal curvature; therefore in all cases the feet and legs must be examined, and any defect attended to. In early cases at this age the morning bath, and friction to the spinal muscles night and morning, with perhaps a stimulating liniment is extremely useful. Exercises with a chest-expander ought to be practised, the strength

of the india-rubber being proportioned to the age. The three exercises with india-rubber straps as described by Mr. Adams (see Fig. 7) are, I think, the best, and these ought to be practised for at least fifteen minutes night and morning resting after each exercise: long walks must be strictly interdicted; music, drawing, and writing-lessons must be curtailed to half-an-hour each at the furthest; and an interval of several hours ought to elapse after each; and in some cases when the spinal muscles are very weak they must even be given up altogether for a year or two.



FIG. 7.—Three Exercises recommended for patients between the age of six and twelve—after Adams.

The patient ought to lie down on the prone-couch (see Fig. 8), from three to five hours

daily, the best times for lying down being perhaps from twelve to one in the forenoon and from four to six in the afternoon. While lying in the prone position a cylindrical cushion ought to be inserted under the insteps so as to prevent the toes from resting upon the couch. In this position the patient can read with ease resting on the elbows.

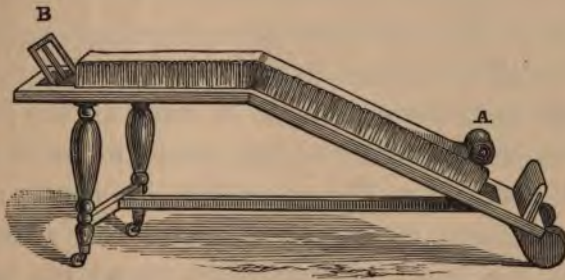


FIG. 8.—Prone-couch showing cylindrical pillow (A) to support the insteps of the patient. Book-rest (B).

In all cases the patient ought to be carefully watched and any awkward habit corrected. These habits are generally the result of a feeling of weariness somewhere, and rest to the weary muscle or muscles is the only remedy. High-heeled boots must in all cases be strictly forbidden. The



patient's bedroom ought to be large and airy ; the bed ought to consist of a hair mattress on a spring mattress, and on no account a feather bed. In some slight cases shoulder-straps will be found useful, but most incipient cases at this age do not require them. If in spite of persevering treatment the incipient curve shews symptoms of increasing rotation, though the patient has been frequently under the observation of the surgeon, the spinal jacket must be applied without waiting for serious rotation, of the vertebræ to develop before giving the requisite support to the weakened muscles. Careful measurements must be taken for the poro-plastic jacket, which ought *always* to be of the *finest* material. The best measurements are: circumference of the chest under the arm-pits above the bust: circumference round the bust; this measurement ought to be taken with great care to avoid undue pressure in the case of girls in whom the bust is well developed: circumference of the waist, and the abdomen two inches below the iliac crests: also the length in front from the measurement above the bust to that below the iliac crests. In the case of children I generally order the jackets to be left unhardened over the upper portion of the chest and the hips. The jacket ought to be thoroughly heated in an

oven or portable stove, and applied—while soft—to the patient in the recumbent position, providing of course that the curve is entirely removed on lying down; otherwise the patient must be self-suspended and the jacket applied in that position. For self-suspension the following apparatus (shown in Fig. 9) is required: it consists of a tripod formed of strong poles about ten feet in length, attached to a triangular piece of iron by hinge-joints; to the centre of this triangle a revolving hook is attached: (a strong revolving hook fitted to a rafter of the ceiling of the room will answer quite as well as the tripod) to this revolving hook a pair of double pulleys, with ropes attached to them, is suspended, and a steel cross-bar and a chamois leather head and chin strap hung upon the hook of the lower pulley. In the process of self-suspension the patient clad in a warm jersey with another garment of linen or calico over it must stand in the centre of the tripod, and the head and chin strap having been carefully adjusted; the patient must raise the hands straight over the head and grasp both ropes with both hands, and must thus slowly draw himself up hand over hand, the arms being always well extended, till he rests on the tips of his toes, which must never leave the ground. This last



precaution is necessary to prevent too great a strain being put upon the ligaments of the neck.

Head and chin strap.

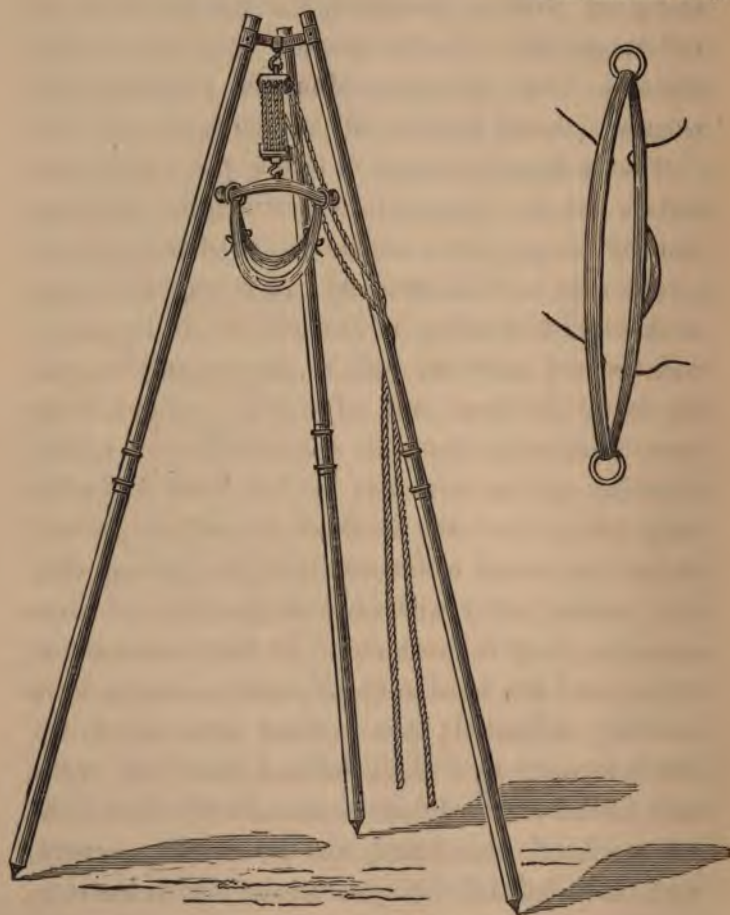


FIG. 9. — Tripod and Self-suspension Apparatus.

The patient will thus draw his spine straight or as straight as he can, without causing pain, but must not draw himself higher should he begin to feel pain. When the patient is thus drawn to his full height, that hand must be highest which is on the side of the concavity of the chief curve, and the upper hand should be clasped over the lower.

The jacket (see Figs. 14 and 15), thoroughly softened in the manner previously described, must now be applied and strapped in front. A long double-headed bandage had better be applied tightly over the jacket while still soft, in order carefully to mould the jacket to the figure, but the chief moulding over the lower arc of the convexity of the principal curve should be done by the hand, as it is of the utmost importance that the fit of the jacket in this part should be perfectly close and accurate. Great care must be taken in applying the jacket to avoid undue pressure on the breasts and hips, and the jacket ought only to reach to the axillæ, and must not act as crutches to the arms as the usual steel appliances are intended to do. The support is thus distributed over the entire area of the jacket, but is principally directed to the lower arc of the convexity of the principal curve. Care must be taken to mould the jacket closely to every portion of the figure, the back part of the

waist requiring especial care, owing to the tendency which the jacket has to bulge out at that part when the patient lies down. Before lacing the jacket tightly the patient, if recumbent, must be placed in a perfectly straight position and this ought to be maintained during the hardening of the jacket, which occupies about five minutes. The patient ought to remain self-suspended if possible until the hardening process has been completed, in order to insure a very close and firm application of the jacket.

In all cases of lateral curvature, that part of the jacket which supports the lower arc of the convexity of the curve must be very carefully moulded.

The jacket must *always* be removed at night, and in incipient cases re-applied in the morning after the bath, exercises, &c., in the recumbent position, but in all cases of marked rotation of the spinal column, the patient must be self-suspended for the re-application of the jacket every morning. Fig. 10 shows the shape of the poro-plastic jacket and the straps in front. During the whole period of treatment of these cases, the exercises previously referred to must be strictly persevered with night and morning,—after the removal of the jacket at night and before applying it in the morning. The exercises ought to be performed slowly and



with precision and always under the observation of a grown person ; otherwise they are frequently

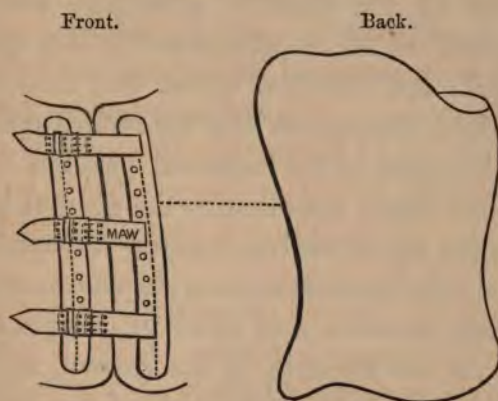


FIG. 10.—Poro-plastic Jacket.

either omitted or not satisfactorily done. The jacket must be softened and re-moulded by the Surgeon, at least, once a fortnight, and in some cases more frequently.

The average time required for the treatment in ordinary incipient cases with patients from six to twelve years of age is from twelve to eighteen months: in more advanced cases of rotated vertebræ, from two to two-and-a-half years of active treatment is generally sufficient, provided



that the jacket is worn for some months afterwards, and re-moulded occasionally, if required. As a rule, by the end of two years of this active treatment all the possible advantage will have been gained as far as straightening the spine is concerned ; and the chief object will then be, as it is indeed throughout the whole treatment, to retain the spine in the improved position by exercises and strict attention to the general health.

From the age of twelve upwards the treatment, though similar in most respects, must be more active as regards exercises and must in great measure depend on the strength of the patient, and the more or less advanced condition of the curve or curves. In cases at this age two-pound dumb-bells should be used horizontally and vertically perhaps five minutes each night and morning, but never long enough to produce fatigue of the muscles of the arms or back : elastic chest-expanders (numbers 2 and 3 of the flat kind are perhaps the best) may be also used with benefit. In all these movements, whether with the dumb-bells or the chest-expanders, the patient ought to stand quite upright, with the shoulders as level as possible ; and the exercises must be performed very slowly. The trapeze exercise used, where practicable, for about five minutes night and

morning, is also very beneficial. Swimming too is a particularly good exercise in most cases.

Fig. 11 practised from ten to fifteen minutes night and morning, using weights of from three to four pounds according to the strength of the patient is a most useful exercise, it was recommended by Mr. Lonsdale.



FIG. 11.—Exercise advised by Mr. Lonsdale—  
after Adams.

Figs. 12 and 13 represent very good exercises with india-rubber bands, the strength of which must be varied according to the powers of the patient. But even at this age the three exercises referred to on p. 46 are sufficient, without any others, when the patient is very weak. The use of the prone-couch for three or four hours daily is necessary in all cases. Great care must be taken in growing girls to mould the jacket carefully at



FIG. 12.—After Adams.



FIG. 13.—After Adams.

the breasts so as to avoid all undue pressure, and in cases not requiring much support the jacket

had better be ordered from the maker, softened (see Fig. 15) over the breasts and hips. This Cocking will attend to, if so directed. In all cases the jacket should be removed at night, and in order to gain the full advantages of the treatment, it is a *sine qua non* that the patient should be seen by the surgeon at least every fourteen days; and as a rule the jacket had better be reheated and moulded at each interview, so that it may be closely adapted to the improving figure, care being always taken as mentioned previously, to give the chief support to the lower arc of the convexity of the principal curve.

Figs. 14 and 15 show the poro-plastic jacket,

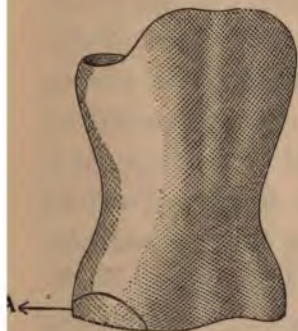


Fig. 14.

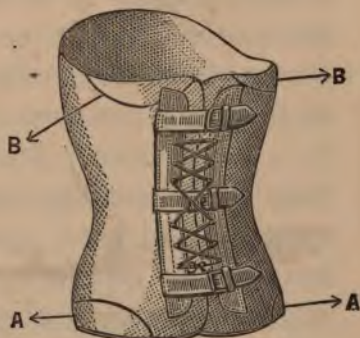


Fig. 15.

Poro-plastic Felt Jacket—back view.

Poro-plastic Felt Jacket—front view.

A and B show the portions of the Jacket which may be left softened if the maker be so directed.



and the portions of it, which may be left softened if directions to this effect are given to the maker.

Self-suspension has a very marked effect in straightening the twisted spine and thus diminishing the rotation. This is proved by the reduction of the undue prominence of the ribs on the convex side of the curvature and the flattening of the projecting shoulder, which effects are produced when the patient in self-suspension draws himself up to his full height. Owing to this improvement in the position of the spine produced by self-suspension we are enabled to adjust a firm appliance to the figure drawn at once into good shape, instead of, as with other instruments, endeavouring to push the unduly prominent ribs gradually into a better position by means of lateral plates, which are intended to act upon the lower arcs of the convexities of the chief curves, the shoulders being at the same time supported by crutches affixed to a pelvic band. The lateral plates are, as I mentioned, doubtless intended to give the chief support to the lower arcs of the chief convexities, but this they generally fail to accomplish effectually, as the amount of pressure exercised by the plates produces frequent loosening of the supporting screws of the plates, even in the best made instruments, and thus, owing to the plates being

allowed to turn partially round, as I have seen in many cases, the pressure of the plate is thrown upon the ribs in the middle of the convexity, instead of being, as it ought to be, upon the lower arc of the curve. This serious drawback is entirely avoided in the poro-plastic jacket, which is moulded to the figure in an improved position in self-suspension and is re-moulded at least every fourteen days, in which time I have rarely seen the slightest appearance of any yielding of the jacket, though the pressure of the ribs in advanced cases is sometimes very great.

The crutches in the usual steel instruments are also entirely avoided in the poro-plastic jacket, which ought to reach barely to the axillæ, and never so high as to permit the shoulders to rest upon the axillary portions of the jacket, which ought to be carefully hollowed out with a knife and scraped quite smooth, as ought all sharp edges of the jacket, wherever they occur.

The objection to the crutches of the usual instruments, as previously mentioned, is that in order to support the weight of the head and shoulders effectually the pressure exercised by the crutches under the axillæ must be so great as to cause considerable pain owing to the interference with the circulation and nerve supply

in the arms, whereas if the support given by the crutches to the shoulders is not considerable, no advantage will be gained by them, as the weight of the head and shoulders will not be removed.

The weight of the usual steel spinal instruments is also a great objection, one of the best I have ever seen, of the pattern of one of the first orthopædic surgeons, weighing four pounds, while the poro-plastic jackets of corresponding size weighed only one pound, and these jackets very rarely exceed this weight by more than a few ounces, while many of the best steel instruments weigh even as much as six pounds.

The pressure of a support in lateral spinal curvature, to be satisfactory, must be distributed over a large area of the body; and this is the case with the close-fitting poro-plastic jacket, the support given by it not being confined to certain points, as it is with most other instruments.

The instrument advocated by Mr. Noble Smith in his work on Deformities is certainly more in accordance with these views than the crutched instruments; even this instrument however possesses the great disadvantages of the lateral plates previously referred to, and in this as in all steel instruments the support is given only to certain points, instead of being distributed over a large area.



The plaster of paris jacket, as advocated by Dr. Sayre, I consider quite unsuited to cases of lateral curvature, for the following reasons: It cannot be removed at night for the performance of the required exercises, which cannot be satisfactorily performed when the body is encased in a tight-fitting jacket. If it is slit down the front and laced up, as suggested by Dr. Sayre and others, a great deal of the support is lost and the jacket soon cracks. The plaster of paris jacket is not at all easy of application and of considerable weight. The constant wearing of the plaster jacket day and night must have the effect of weakening the already feeble muscles of the back, owing to the great heat of body which it produces.

Dr. MacNaughton Jones, in his recent work on Spinal Curvatures, highly recommends the treatment of lateral curvature by self-suspension and the poro-plastic jacket, and favours the theory that lateral curvatures are the result of debility and are not caused by undue muscular contraction.

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## CHAPTER V.

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### CASES OF LATERAL CURVATURE.

THE few following cases will show the great advantage of the treatment by partial recumbency: exercises: and the use of the poro-plastic jacket, with and without self-suspension. The successful cases to which reference is made include cases of incipient curvature: of moderate rotation: and cases of extreme rotation, in which last a perfect cure was impossible, but in which great and permanent benefit was derived, and this in some cases in which steel instruments had been used for a lengthened period.

### CASES.

#### CASE OF INCIPIENT CURVATURE.

Miss W., aged six years, was brought to me in September, 1878; she was a slight healthy girl, of healthy parentage. About six months before consulting me her mother noticed her frequently

standing in an awkward position, resting on one leg, she also complained of weakness but no pain in her back; her right shoulder seemed to be higher than the left, she had not sat up much at school for writing or music lessons; she had been according to her mother's account losing flesh for twelve months. On examining her back I detected double curves, the primary one being lumbar. On lying down both curves were entirely removed and on stooping forward there was no undue prominence of the ribs to indicate vertebral rotation; in fact in this position the curves were removed. I ordered the patient to lie down for three hours daily, advised tepid bathing, and friction to the muscles of the back every morning and the three exercises as figured on page 46, each exercise for five minutes night and morning. I directed that attention should be paid to the general health and that fatiguing studies and long walks should be avoided. In spite of this treatment in three months' time the curves seemed to have increased; I therefore applied the poro-plastic jacket in the recumbent posture. I advised the same hygienic treatment and exercises as before; I re-moulded the jacket every second or third week; and after eighteen months I could detect no curve; the back had become quite straight and the spinal muscles

strong enough to support the spine in the erect position; the patient was now able to throw aside the jacket and has continued straight ever since.

Case No. 2 resembles the first in some respects. It occurred in a tall long-backed girl of fourteen, whom I saw first in 1881, and was accompanied with severe pain, almost hysterical in intensity, the chief seats of the pain being in the latissimi dorsi muscles on both sides, where the slightest pressure caused great distress. In this case also, the family history was good, and I was consulted chiefly on account of the pain in the back and sides. The menstrual period was regular, and free from pain. On examining the back, I found a double curve, as in the former case, and no marked rotation; the curvature seemed to have been produced by sitting up too long at writing and music lessons at school; I advised the discontinuance of these studies, rest on a prone-couch for four hours daily, hot sponging of the painful muscles of the back and rubbing with belladonna ointment. Under this treatment the pain certainly diminished, but the curves seemed rather to increase: so after two months I applied a poro-plastic jacket which had been left softened over the breasts and hips as described on p. 57.

I ordered the bathing and rubbing of the back

and the use of the prone-couch to be continued. Within a month from the first application of the jacket the pains had almost entirely ceased and the patient began exercises with a No. 2 india-rubber chest-expander for fifteen minutes night and morning, and the daily use of tepid salt-water baths, which I have found useful in most cases; the jacket was re-moulded at fortnightly intervals and the improvement was continuous and permanent. After twelve months the patient was able to leave off the jacket and is now quite upright and able to walk four miles without fatigue, and the muscles are free from all pain, and have developed to a great extent, the patient having also grown considerably in height. In this case also, as in the first, self-suspension was unnecessary the jacket being re-applied daily to the patient while recumbent.

The 3rd case is one of lateral curvature with comparatively slight rotation of the vertebræ. Miss S., aged seventeen, consulted me March, 1883: she was a tall, well-formed girl, rather anæmic, but otherwise healthy: there was no history of congenital lateral curvature. For the previous twelve months she had not been strong, and her mother had thought that her right shoulder was growing out; she had not been ac-



customed to sitting or standing long in constrained attitudes, but complained of pain in her right side when tired; she was rather short-breathed on exertion. On examination I found double lateral curves not severe; the spinous processes only deviated from the perpendicular slightly, but still quite sufficiently to be apparent to her mother, when her attention was drawn to the fact. Her hips were almost level, but the right scapula was unduly prominent and the right ribs decidedly projected unduly on stooping forward, and also to a certain extent in the erect posture. There was great weakness of the spinal muscles, and a sense of fatigue on standing long. Her chest was well-formed and there was no marked prominence of the left ribs and costo-sternal cartilages in front: I prescribed tinct. ferri perchloridi and strychnine and also cod liver oil; I ordered her to lie down for four hours daily on the prone-couch, to have tepid baths and rubbing of the spinal muscles every morning; and to avoid all over-fatigue, to take a nourishing diet; to have driving and moderate walking exercise. She used No. 4 flat india-rubber chest-expander for fifteen minutes night and morning, the exercise being the extension of the arms slowly thirty or forty times, resting when tired: she also went through the

sawing motion (see Fig. 7, at page 46) with an india-rubber strap of the same strength as the expander for an equal length of time. I also applied a poro-plastic jacket, in the recumbent posture. No self-suspension was required the amount of rotation being so very slight that the spine almost recovered its normal position on lying down. Before the jacket had set I moulded it so as to give considerable support to the lower ribs in the convexity of the curves. I directed the jacket to be removed at night and carefully re-applied in the morning, after the bath and exercises, in the recumbent posture, the patient being always placed in as straight a position as possible. The effect of the treatment soon became apparent; the anæmia disappeared, the appetite which had been bad, soon returned; all spinal pain ceased and with it the feeling of langour and dyspnæa.

In four months' time I could detect no deviation of the spinous processes when the jacket was off, and the prominence of the shoulder had disappeared, the undue protuberance of the ribs on the right side was also markedly less, and the patient had gained flesh. The muscles of the back had also greatly developed; the shoulders and the hips were now level. The patient still wears the

jacket and will continue to do so for twelve months more at least, having it re-moulded every fourteen days.

Case No. 4: Miss C., aged twenty-three, consulted me in Oct., 1881; she was a tall slight girl who would have been particularly well-formed, but for a very severe right dorsal lateral curvature. In this patient, at my first interview, three years ago, the spinous processes of the dorsal vertebræ had so far deviated to the right in a long curve that they were covered to the extent of two inches in a lateral direction by the right scapula when the patient stood in an easy position. The right ribs so pressed upon the lung as to produce a state of chronic congestion, with considerable irritative cough. The deformity was first noticed at the age of eleven, and was presumed to have been caused by over-fatigue in taking long walks, and increased by a too meagre diet at school. The parents residing abroad, the patient was put under the care of a specialist at the age of twelve and continued under his treatment nine years, wearing a well adjusted steel support with the usual side-plates and crutches during the whole of this time. In October, 1881, however, the father of the patient came to the conclusion that his daughter was gradually becoming more deformed,



and that her general health was failing. It was at this time that I first saw her, and she was then in the condition I have described. I adjusted a poro-plastic jacket while the patient was self-suspended, advised rest in the recumbent or prone posture for four hours daily, forbade all over-fatigue, and prescribed a nourishing diet. I directed the jacket to be re-applied every morning always while the patient was self-suspended and re-adjusted it myself every fourteen days for the first twelve months, and every month for the following twelve months. By this treatment, with the use of exercises, trapeze and chest expander No. 4, for twenty minutes night and morning during the second year, I succeeded in re-establishing her general health, the cough having disappeared in about six months. At the end of two years the spinous processes of the dorsal curve, which had been, when the treatment was first commenced, concealed as mentioned, to the extent of two inches by the right scapula, had so far recovered their natural position as to be now felt three inches nearer the mesial line when the patient stood upright without the jacket. (This patient was, when she first consulted me, considerably more deformed than the case depicted in Fig. 5 in which, even in the greatest concavity



of the dorsal curve, the spinous processes are not covered by the scapula.) The father of this patient considers that more good was done in twelve months by the self-suspension and poro-plastic jacket treatment, than during the whole nine years she wore the steel support, notwithstanding the fact that the last-mentioned treatment was pursued at the most advantageous age and in great part before much structural change had taken place in the vertebræ. The patient has now given up the poro-plastic jacket for four months, wearing only well-fitting stays with slight steel bands behind placed in an upright position beside the eyelet-holes; and she still retains the improved condition previously described. Her general health also continues good.

I will refer to one other case, caused by unequal length of the lower limbs from arrest of development. Miss P., aged twenty-one, came under my care in August, 1882, suffering from considerable lumbar curvature, the crest of the right ilium being one inch higher than the left. The patient had worn a steel instrument for three years but with no benefit, though it had been constantly re-adjusted at short intervals.

When I saw her first she was well-nourished, but anæmic, and the muscles of her back were so

weak that she could not walk more than a hundred yards without considerable pain in the lumbar region, and a feeling of faintness: even with the steel support a quarter of a mile was most fatiguing to her. I could not learn that there was any family history of curvature of the spine, and found that on lying down the spine recovered its normal position. On measuring the length of the legs I found that the left was an inch shorter than the right, and on placing the patient's left foot on a book of this thickness when she stood erect, the curvature of the spine was removed and the crests of the ilia became level. The calf of the left leg was one inch less in circumference than the right: I ordered her to have the left boot made with an inner sole of cork three-quarters of an inch thick and the outer sole a quarter of an inch thicker than the right, and to wear laced boots with flat heels. I recommended morning baths, tepid in winter and cold in summer, moderate exercise, friction to the muscles of the back night and morning and recumbency for for three or four hours daily, with the use of No. 4 flat elastic chest-expander for fifteen minutes night and morning. Under this treatment she improved steadily, but after two months I thought it advisable to apply a light poro-plastic

jacket without self-suspension in order that she might thus take longer walks without fatigue, continuing the exercises twice daily before applying the jacket in the morning and after removing it at night. She now quickly improved, and after eighteen months was able to give up the jacket and on measurement I found the difference in the length of the legs less than half-an-inch, the lumbar curve being hardly perceptible. The patient can now walk two or three miles without fatigue.

I have as I mentioned in the preface applied the poro-plastic jackets, made by Cocking of Plymouth, nearly three hundred times and I have never yet had to return a misfit.





